BINDING DEVICE

Technical field of the invention

This invention relates to a device for binding wire round pulp bales, where the wire is taken from a wire magazine, preferably a coil with wire, comprising a feed means for feeding and stretching the wire, a guide means for guiding the wire round the object during the feed, means for cutting off the stretched wire and retaining and twisting together the wire ends, and a take-up unit for taking up the wire loop resulting from the stretching of the wire.

Short description of prior art

Pulp bales are bound round by known devices of the kind described above, and examples of such devices are described in SE-380 496-A, SE-509 532-C and SE-509 534-C. As described in these publications, the free end of the wire is advanced through the means for cutting off and twisting together and is guided around the bale by a guide means. When the wire for the second time reaches the means for cutting off and twisting together, the feed is stopped and the wire end is caught and retained. The guide means releases the wire, and the feed means is reversed to stretch the wire round the bale, whereafter the wire is cut off, and the ends are twisted to a knot. The re-fed wire is used at the next binding operation. The stretching of the wire yields a relatively great wire length, which must be taken up by the take-up unit. At such devices, problems often arise in that the wire entangles in the take-up unit. This results in operation breakdowns.

Object and short description of the invention

This invention has the object to provide a take-up unit, which has higher operation safety and capacity and renders possible a high feed speed of the wire. This object is achieved in principle in that the take-up unit comprises a longitudinal, relatively flat space (wire take-up space), which in cross-section has a substantially rectangular shape with long sides and short sides. The distance between the long sides (width) is adapted to the wire diameter, so that the wire cannot lie double, and the distance between the short sides (height) is such that the wire can lie in loops between the short sides without folding. The wire take-up space has at one short side a wider portion, a groove, adapted to meet the wire at its stretching.

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Short description of the drawings illustrating an embodiment of the invention

- Fig.1 is a partially opened view of a binding machine according to the invention during wire feed.
- Fig. 2 is a partially opened view of the machine during wire stretching.
- Fig. 3 shows on an enlarged scale a feed unit comprised in Fig. 1.
- Fig. 4 is a lateral view of a portion of a wire take-up unit shown in Fig. 1.
- Fig. 5 is an end view of the detail shown in Fig. 4.
- Fig. 6 is a section taken along the line 6-6 in Fig. 4 on an enlarged scale.
- Fig. 7 shows a detail from Fig. 2 with the wire in a different position.

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Description in detail of a preferred embodiment shown

The binding device shown in the Figures has a stand 10, which carries a number of units for various partial operations. A feed unit 11 is provided to feed binding wire, usually steel wire, 12 with a diameter D from a wire magazine (not shown) in the form of a coil, from which the wire is reeled off. A wire guide means in the form of a bar 14 extends about the pulp bale 13 to be bound round. The pulp bale 13 is moved by bale feed conveyor 15,16 into the guide bar 14 perpendicularly to the paper plane. A binding unit 17 comprises means for cutting off the wire, catch the wire ends and twist the same. The binding unit is conventional and is not shown and described in detail, but reference is made to the patent specifications mentioned above.

The feed unit 11 is shown in the Figures with its cover metal sheet removed, and it is shown on an enlarged scale in Fig. 3. It comprises a feed wheel 20, which is driven by a reversible motor (not shown), and the wire 12 is clamped against the feed wheel by counter-rolls 19,21,22 to ensure friction force against the wire. The wire is moved over a pulley 23 via a guide wheel 24 over three pulleys 25,26,27 and a guide wheel 28 to the feed wheel 20. The three pulleys 25-27 are located on a block 30, which is guided on a guide pin 29 fixed on the stand, which guide pin is loaded by a spring 31 towards an outer end position, and the wire tension will be counter-acted by the spring force. The spring force is suitably adapted so that the block 30 at normal wire tension is just in its outer end position. As the wire tension produces a resulting force on the block 30 which is in parallel with and coaxial, or almost coaxial with the guide of the block, no breaking forces will affect the guide of the block.

Figure 1 shows the binding device during the feed of the wire, when the feed wheel 20 has advanced the free end 32 of the wire 12 round the bale 13, and the wire end then had been guided by the guide bar 14 so that it has returned to the binding unit 17. The binding unit 17 then catches the wire end 32 and retains it. The wire guide bar 14 is axially divisible and is opened so that the wire 12 is released, and when the feed wheel 20 is reversed, the wire will be stretched round the bale 13, as shown in Fig. 2. When the wire 12 is stretched, as shown in Figure 2, the re-fed wire will be fed into a longitudinal horizontal or substantially horizontal wire take-up space 34, which is a part of the wire take-up unit 35. When the wire is stretched, the binding unit 17 will cut off the wire and twist the ends to a knot.

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The wire take-up space 34 is shown in Figure 4 in a lateral view and in Figure 5 in an end view. The space is formed by two walls 40,41 (suitably metal sheets), which are screwn together with a partition wall 42, so that the space 34 in cross-section has a substantially rectangular form with short sides 48,49 and long sides 50,51. The distance between the short sides 48,49 (width) is slightly greater than the wire diameter D, as best shown in Figure 6. The wire, therefore, cannot be wedged tightly between the walls 40,41 or place itself double in width. The walls 40,41 have at their ends (at the upper short side of the wire take-up space in the Figures) longitudinal grooves 52,53 so that the wire take-up space 34 upwardly is widened to T-shape and forms a wider portion, the wire guide space 43 for the wire. The width of the wire guide space 43 can be, for example, three wire diameters, where every groove 52,53 in the walls 40,41 has a depth of about one wire diameter. The wire guide space 43 must not be too wide. It is suitable that the groove (52,53) has a width of fully one wire diameter, and depth of about 0.5 to 5 times the wire diameter or, still more suitable, about 1 to 2 times the wire diameter.

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The wire guide space 43 is located in its orientation so that the re-fed wire is fed into it. The wire sways slightly in lateral direction when it is pressed into the grooves 52,53 and, therefore, is retained in the wire guide space 43 a longer distance before it falls out of the grooves 52,53 as a long soft bow 44 to the lower short side 49 of the wire take-up space 34. Owing to the resilience of the steel wire, the leading edge of the loop 33 does not collapse, but remains in a bow 45 between the short sides 48,49 of the wire take-up space 34, as shown in Figure 7. When then the wire continues to be fed into the space 34, the bow 44 will be pressed together forward, and at the same time a third loop is formed, as shown in Figure 2. In this way the loops are stacked horizontally one after the other, and the wire take-up space 34, therefore,can receive along its entire length A a great wire length in relation to its size with no risk that the wire entangles or forms snarls or folds. The space 34 must not be so high (have such a great distance between its short sides 48,49), that a loop can be formed above another loop, i.e. the height must be adapted to the flexural resistance of the wire. The wire take-up space should have a length A so great that at least two loops can be formed one after the other in the wire take-up space 34. The wire take-up space, of course, can be still longer in order to be able to take up more wire.

Suitable dimensions of the wire take-up space in a device according to the embodiment shown with a wire diameter D of, for example, 2,2 mm can be a length A of about 1,5 m, distance between the short sides 48,49 of about 0,2 m, distance between the long sides 50,51 of about 3 mm, and a depth of the grooves 52,53 of about 3 mm and a width of about 3 mm.

For a device greater or smaller than the embodiment shown, of course, other measures are suitable and must, as mentioned above, of course be adapted to the wire diameter.

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At the embodiment shown, the wire guide space is a part of the upper portion of the wire take-up space. Depending on the design of the device, the wire guide space, of course, can be another part of the wire take-up space, for example a part of the lower portion of the wire take-up space.

Instead of having a longitudinal groove in each of the walls, only one wall can include one groove, where the wire take-up space is widened to L-shape for forming the wire guide space.

The reliability of the take-up of wire in a device according to the invention has proved to be considerably better than at known devices, and the taking-up allows a very high wire speed.

When a wire has been bound round the bale, as described above, the bale is advanced through a certain distance by the bale conveyor 15,16 for an additional binding. The feed wheel 20 starts to feed the wire end again, and at first the wire is taken from the earlier re-fed loop 33, and the feed wheel 20 comes up quickly to full feed speed which, for example, can be 4,5 m/s. When the loop ends and reaches the three pulleys 25-27 on the block 30, the wire will start to be drawn from the pulley 23, and the idle wire starts to be accelerated up to the feed speed. At the jerk caused by the loop reaching the pulleys 25-27 the spring 31 will be compressed and thereby softens the jerk in the idle portion of the wire, so that it can be accelerated softly. The spring must not be prestressed and should have such a progressivity that the wire force can manage to break the return movement of the block, so that the block does not remain in its normal position, because this would involve the risk of snarls and knots in the wire, although the movement of the block 30, when the end of the wire loop 33 reaches the three pulleys 25-27 of the block, reduces the risk thereof. By the resilient block 30 the risk of the formation of snarls and knots in the wire is considerably reduced, and at the same time the strain on the feed wheel 20 and its motor and possible gearbox is decreased, which can increase the service life of these parts.

The invention, of course, is not restricted to the embodiment described and shown, but can be varied within the scope of the claims with reference to the description.

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